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Stone Age of Armenia

Kanazawa University

2014

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Kanazawa University

Institute of Archaeology and Ethnography of
the National Academy of Sciences of
the Republic of Armenia

Gfoeller Fund of America Corporation, Armenian Branch

Center for Cultural Resource Studies, Kanazawa University

Stone Age of Armenia

A Guide-book to the Stone Age Archaeology in the Republic of Armenia

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Pavel AVETISYAN, Sumio FUJII

Monograph of the JSPS-Bilateral Joint Research Project

Center for Cultural Resource Studies,
Kanazawa University

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Introduction

Our initial reason for producing this volume was to publish the proceedings of the workshop titled "Stone Age in Armenia". This workshop was organized by staff at the Institute of Archaeology and Ethnography of the National Academy of Sciences of the Republic of Armenia, and Kanazawa University, Japan, with the support of the Armenian Branch of the Gfoeller fund of America Corporation. The main aim of the workshop was to share and exchange a growing body of knowledge emerging from archaeological investigations by researchers in Armenia. Additionally, organizers – who included the authors of this paper – invited young researchers and graduate students to make presentations at the workshop, since it was thought their involvement would be indispensable to the future development of the field of archaeology. The workshop was held in the library at the Institute of Archaeology and Ethnography, Republic of Armenia, on 5 March 2013 (Figure 1). Fifteen talks were given, introducing the latest results from field studies and scientific analyses dating from the Paleolithic, Neolithic, and Chalcolithic periods. Although the workshop was quite long and tiring, participants filled the room with a palpable sense of excitement (Figures 2-8).


Սեմինար

Քարի դարը Հայաստանում

Քարեդարյան հնագիտության վերջին նվաճումները Հայաստանի Հանրապետությունում: Անցած ուղին և հետանկարները

Վերջին շրջանում Հայաստանի քարի դարի հուշարձանների հետազոտման տեսական, ժամանակագրական և հնամիջավայրային ուսումնասիրությունների ասպարեզում որակական նոր տեղաշարժ է նկատվում: Չնայած դեռես առկա բազմաթիվ «բացերին», վերջին տարիների ընթացքում մեր գիտելիքներն այս ուղղությամբ էապես ավելացել են: Սեմինարում կներկայացվեն հայ մասնագետների 15 զեկուցումներ՝ նվիրված քարի դարի նորագույն հետազոտություններին Հայաստանում: Մեր հիմնական նպատակն է տեղեկություններ շրջանառել և փոխանակել նոր հնագիտական պեղումների և հետազոտությունների արդյունքների վերաբերյալ: Սեմինարի ընթացքում հուսով ենք խնամատարել արդի գիտական նվաճումների նշանակությունը և արժևորել քարեդարյան հնագիտության զարգացման հետանկարները Հայաստանում:

- Տեղը՝ Հնագիտության և ազգագրության ինստիտուտի գրադարան (Չարենցի փողոց)
- Օրը և ժամը՝ Մարտի 5, 11:00
- Կազմակերպիչներ՝ Բորիս Գասպարյան (borisg@virtualarmenia.am, Հեռ. 055 411 459)
  Մակոտո Արիմուրա (arimura.mako@gmail.com, Հեռ. 098 726 462)

Workshop for

Stone Age in Armenia

What' s done and what must be done. Recent Achievements of Stone Age Archaeology in the Republic of Armenia

A new wave of research is now beginning to lay a robust theoretical, chronological, and paleoenvironmental foundation for the county' s Stone Age sites. Although there are still many "missing links" periods in our knowledge, it is true that our knowledge in this direction has dramatically increased since last decade.

The workshop will give some 15 presentations by Armenian specialists studying Stone Age of Armenia to present their recent activities. The main purpose is to share and exchange information from recent archaeological excavations and studies. Through the workshop, we hope that we will understand our achievements at the present and take future perspective for Stone Age Archaeology in Armenia.

- Place: Library in the Institute of Archaeology and Ethnography (Charents street)
- Day and time: 5 March, 11:00 AM
- Contact persons: Boris Gasparyan (borisg@virtualarmenia.am, tel: 055 411 459)
  Makoto Arimura (arimura.mako@gmail.com, tel: 098 726 462)

Institute of Archaeology and Ethnography, National Academy of Sciences of RA

"Gfoeller" Fund of America Corporation Armenian Branch

Kanazawa University

Figure 1
Announcement posters for the workshop in Armenian and English.

Since some authors prepared their papers after the workshop's conclusion, and others not in attendance expressed interest in contributing to the series of papers, we decided to prepare a monograph presenting recent findings of archaeological research conducted on the Stone Age sites in the Republic of Armenia.

By means of this publication, we hope that readers will become aware of our achievements to date, and come to understand the future prospects for Stone Age archaeology in Armenia. In addition, this workshop marks the beginning of cooperative efforts between Armenian and Japanese archaeologists - after all, both countries have unique and long-standing historical-cultural traditions in this field.

Pavel Avetisyan

Director of the Institute of Archaeology and Ethnography, the National Academy of Sciences of the Republic of Armenia

Sumio Fujii

Director of the Center for Cultural Resource Studies, Kanazawa University, Japan

Figure 2
Participants and audince in the workshop.

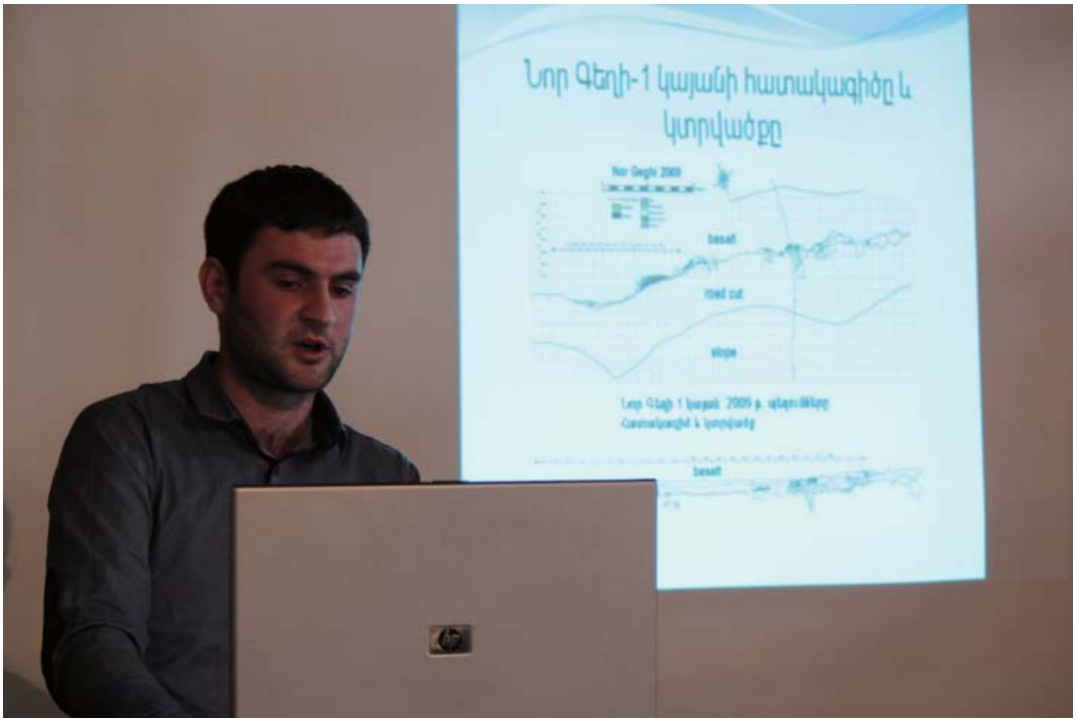

Figure 3
Presentation by Karen Azatyan.

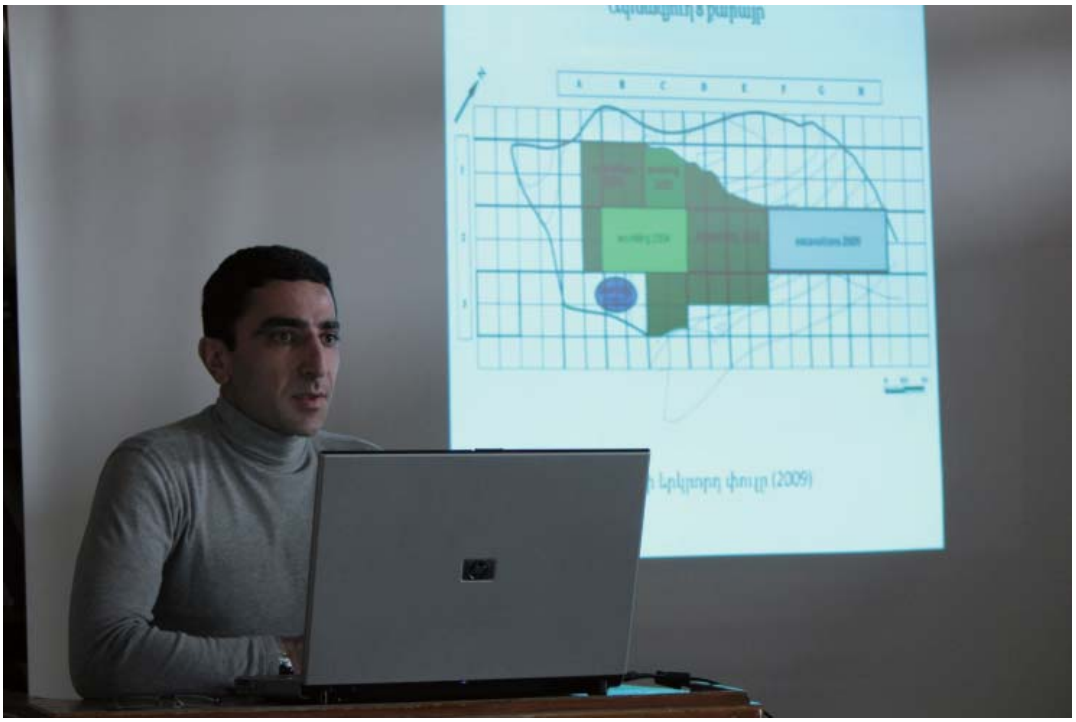

Figure 4
Presentation by Arthur Petrosyan.

Figure 5
Presentation by Diana Zardaryan.

Figure 6
Participants and audience in the workshop.

Figure 7
Young participants.

Figure 8
Participants and audience in the workshop.

Late Chalcolithic and Medieval Archaeobotanical Remains from Areni-1 (Birds' Cave), Armenia

Alexia Smith, Tamara Bagoyan, Ivan Gabrielyan, Ron Pinhasi and Boris Gasparyan

1. Introduction

Areni-1 (also known as Birds' Cave) is a three-chambered karstic cave located on the left-hand side of the Arpa River basin, a tributary of the River Araxes, within the eastern portion of the modern village of Areni in the Vayots Dzor Region of southern Armenia (Figure 1). Excavations at the site began in 2007 and were directed by Boris Gasparyan (Institute of Archaeology and Ethnography, National Academy of Sciences, Armenia) and co-directed by Ron Pinhasi (School of Archaeology, University College Dublin, Ireland) and Gregory E. Areshian (Cotsen Institute of Archaeology at UCLA, USA). The major significance of the site was abundantly clear during the initial excavations when very well preserved Chalcolithic (4,300–3,400 Cal BC) and Medieval (4th–18th centuries AD) occupations were exposed (Areshian *et al*. 2012; Pinhasi *et al*. 2010; Wilkinson *et al*. 2012). Chalcolithic finds within the first gallery of the cave include numerous large storage vessels, some of which contain human skulls of adolescent females. Grape remains and vessels typical of wine storage, associated with chemical analyses of the contents of the vessels, point to Chalcolithic wine production at the site (Barnard *et al*. 2011). It appears that from the end of the 5th millennium BC onwards, people used the cave for different purposes—as a habitation, for keeping animals and storing plant foods, for the production of wine, as well as for ritual purposes. The data from the cave demonstrate clear evidence for incipient social complexity. The workshops, wine producing complex, and the funerary features or "burials" represent a common ritual and production oriented complex.

Medieval finds in the cave span the entire Medieval period from the 4th to the 18th centuries AD. Remains of a well preserved circular dwelling span the 7th to 9th centuries AD. Later finds dating to the 11th to 14th centuries AD include structures, a fragment of an Armenian manuscript, two well-preserved ovens, a wine-storage jar, associated pottery, fragments of glass, and other small finds (Areshian *et al*. 2012; Pinhasi *et al*. 2010; Wilkinson *et al*. 2012). A group of limited small finds dated via 14C dating document early usage of the cave between the 4th and the 7th centuries AD as well as later during the 15th to 18th centuries AD.

Very limited, and what appear to be short-lived, Middle and Late Bronze Age and Iron Age occupations are also evident at Areni-1. Roughly a dozen artifacts dating to these time periods (ceramic sherds, a bronze axe, and jewelry fragments) were recovered from Trenches 1 to 5. A lack of associated architecture and an overall scarcity of finds underscores the brevity of these occupations.

Minimal temperature oscillations and constant levels of low humidity within the cave have provided an ideal environment for preservation of organic remains. As a consequence of this constant microclimate, Areni-1 has yielded large quantities of exceptionally well-preserved organic remains including the world's oldest leather shoe (Pinhasi *et al*. 2010) along with basketry and clothing (Stapleton *et al*. this volume). Large volumes of Late Chalcolithic and Medieval desiccated plant remains have also been preserved, presenting a rare opportunity to better understand plant use in Armenia during a period of increasing social complexity. The main goals of archaeobotanical research at the site are to: 1) determine the range of species and plant parts present within the cave and assess their economic importance to the inhabitants of the site; 2) consider the range of plant husbandry techniques used; 3) assess the domestication status of a number of fruit crops and better understand the nature and timing of domestication events at a regional level; and 4) explore the ritual use of plants within the cave. Owing to the volume of plant material at Areni-1, the analysis and identification of plant remains is a tremendous task and research is ongoing. This report provides preliminary results of the study of Chalcolithic and Medieval plant use at Areni-1 and presents the main genera identified to date.

2. Stratigraphy of the site

Six trenches are currently being excavated at Areni-1 (Figure 2). Trench 1 is located in the main or first gallery inside the cave and contains artifacts and features that clearly relate to funerary ritual, including human remains, as well as wine making paraphernalia dating to 4,000–3,800 Cal BC

(Figure 3). Trench 2, within the same gallery as Trench 1, has yielded pots containing cremations, as well as isolated human remains recovered from loci between the pots (Figure 4: 1). Trench 3 is located under the overhang of the cave on the outer edge at the main entrance to the first gallery (Figure 5: 1). This trench contains Medieval dwellings cutting into at least three Late Chalcolithic occupational phases designated as Chalcolithic Horizons I–III (4,300–3,400 Cal BC). Of the three horizons, the first uppermost horizon tends to be most truncated; it is present only in Trench 3 and the slope at the entrance of the cave complex. Within Trench 3, Horizon I was damaged by the construction of an Early Medieval (7th to 9th centuries AD) house or hut and by later Medieval (11th to 14th centuries AD) storage pits and ovens. Horizon I is represented by hard packed and repeatedly rebuilt dirt floors atop household pits and jar burials and dates to the final phase of the Late Chalcolithic (3,700–3,400 Cal BC). Chalcolithic Horizon II underlies Horizon I but is separated from it by a layer of zoogenic humus (dung layer). Horizon II occupies a more extensive area beginning in Trench 3, outside the entrance to the first gallery and extends into the cave, to the rear part of the first gallery spanning Trenches 1 and 2. It also reaches into Trench 3, where it is characterized by hard packed and repeatedly finished floors and wooden constructions or buildings and large, unfired bins. Radiocarbon dates from Horizon II yield a date range of 4,000–3,800 Cal BC, which places it in the middle phase of the Late Chalcolithic. The third Chalcolithic Horizon encompasses a rather small area and appears in multiple areas beneath Horizon II. Horizon III is separated from Horizon II by a layer of zoogenic humus in Trench 3 and inside the first gallery, where it spans Trenches 1 and 2. Traces of very high quality plastered floors and partially destroyed stone constructions (damaged by intrusive bins dug during Horizon II) are recorded in Trench 3. Dates for this Horizon range between 4,300–4,000 Cal BC placing the Horizon III occupation in the early phase of the Late Chalcolithic.

Towards the front of the cave on the slope (Trenches 4, 5 and 6), the stratigraphy is highly complex and while discrete Late Chalcolithic and Medieval strata exist, certain layers exhibit considerable mixing. In Trench 4 Chalcolithic Horizon I is washed and mixed with the colluvial deposits (Figure 6: 1). A Chalcolithic garbage layer partly exposed in Trench 4 most probably belongs to Horizon II. One of the Chalcolithic Horizons partly opened in the section of Trench 4, extending above the bedrock is dated to 5,260–4,960 Cal BC (OxA-23169) and most likely belongs to the Early Chalcolithic (Figure 6: 2). In Trench 5, portions of a hard packed and repeatedly rebuilt dirt floor with a household pit were discovered (Figure 7). Scant remains of other stone structures are visible. Most of the finds are washed and redeposited because of a strong erosion process existing at the slope in front of the cave. Trench 6 was recently opened, exposing part

of a Chalcolithic horizon beneath thick colluvial deposits. Judging from the pottery sherds, this occupation is associated with Horizon III.

Plant remains are distributed unevenly throughout the site. Throughout the cave, large concentrations of plant remains have been recovered from ceramic vessels and associated contexts in Trenches 1, 2, 3 and 4 (Figures 3: 2, 4: 2 and 5: 2).

3. Methods

A comprehensive sampling strategy was adopted at Areni-1, and archaeobotanical samples were collected from every archaeological context. Each sample consisted of 5 L of sediment. Since the plant remains are desiccated, and contact with water results in their disintegration, dry sieving was used to recover the archaeobotanical remains. All sediment samples were sieved using a 1 mm sieve and material <1 mm was discarded. It is likely that small weed seeds and plant parts are lost as a result of this strategy, but since recovering desiccated plant remains by dry sieving is such a labor intensive process, and emphasis was placed on examining economic species from each context, it was deemed a necessary compromise. Similar compromises have been reached at other sites where copious amounts of desiccated plant remains have been preserved (e.g. Van der Veen 2011, pp. 15-17). Of the sieved material in the >1 mm fraction, 1 L of filtered soil was collected for investigation and the remaining filtered soil was placed in a labeled bag and stored within the cave for future generations to examine. The 1 L bag of filtered soil was then subject to detailed analysis and all plant remains, bones, pottery fragments, etc., were separated via hand-picking and labeled appropriately.

All plant remains were examined using a binocular microscope and identified using the Armenian Archaeobotanical Reference Collection, which has been collected in triplicate. Collections are housed at the Institute of Archaeology and Ethnography and the Institute of Botany in Yerevan, as well as the Department of Anthropology at the University of Connecticut. The botanical terminology used within this report follows the Flora of Armenia (Takhtajan 1954-1987; 1995; 2001-2010) and the *Vascular Plants of Russia and Adjacent States* (Cherepanov 1995). Since analysis of samples is ongoing, this report does not include final seed and plant part counts: these data will be provided in an upcoming report.

4. Plant remains from Areni-1

Plant remains recovered from Areni-1 include vast quantities of well-preserved seeds, fruits, stones

or endocarps, and stems of both wild and cultivated plants as well as desiccated flowers, blossoms, leaves, wood, and vine branches. A list of the genera identified to date from Late Chalcolithic, Medieval, and mixed contexts is provided in Table 1. A diverse range of taxa have been identified, documenting the richness of plant use in antiquity at Areni-1. While distinct differences are evident between the Late Chalcolithic and the Medieval strata, continuity in plant use is also evident; many of the species observed in the cave continue to be used in the village of Areni today. The following discussion outlines the range of food plants recovered, including fruits, cereals, and legumes, as well as plants used for their fibers and other purposes.

4.1. Fruits

Numerous fruits remains have been recovered from Areni-1 (Figures 8, 9 and 10). Large numbers of well-preserved endocarps or stones from fruit trees document the presence and intensive use of *Prunus* L. (plum), *Armeniaca* Mill. (apricot), *Persica* Mill. (peach), *Amygdalus* L. (almond), and *Cerasus* Mill. (cherry) during the Medieval period. *Prunus* endocarps were also very common within the Late Chalcolithic strata. Other tree, shrub, or vine fruits present at Areni-1 during the Medieval period include *Juglans* L. (walnut), *Pyrus* L. (pear), *Cornus* L. (Cornelian cherry/dogwood), *Rubus* L. (blackberry/raspberry), and *Vitis* L. (grape), all of which continue to be heavily used in the area today (Table 1). *Juniperus* sp. (juniper) fruit were also recovered from Medieval levels. Sturtevant (Hedrick 1919) reports the fruit of a variety of *Juniperus* species as being edible and highly valued in many parts of the world, but their use at Areni-1 is unclear.

Celtis L. (hackberry) endocarps were also found in great abundance within both Late Chalcolithic and Medieval levels and *Celtis glabrata* Stev. ex Planch. trees are frequently encountered in the Arpa River basin and its tributaries today (Figure 8: 1-3). Sturtevant (Hedrick 1919) lists a variety of *Celtis* species and notes that they possess a sweet and edible fruit. This sentiment is repeated by Medieval Armenian medic Amirdovlat Amasiatsi, who notes in his encyclopedic dictionary that the fruits of the hackberry tree are sweet and delicious. The fruits and other parts of the plant have historically been used for medical purposes and as a hair dye (Vardanyan 1990, pp. 291-292). In addition, ethnographic reports from the villagers at Areni-1 indicate that *Celtis* fruits are ground into a powder and used in conjunction with flour to enhance the flavor of bread.

Given the vast number of *Celtis* finds, it is clear that hackberry fruits were intentionally collected at Areni. While reports of *Celtis* from other sites are not widespread, they do exist. Simchoni and Kislev (2011), for example, report the discovery of approximately 300 *Celtis*

australis stones from Iron Age Tel Rehov in Israel. *Celtis* finds have also been reported from Epipalaeolithic levels at Öküzini (Martinoli and Jacomet 2004) and Neolithic Çatalhöyük (Fairbairn *et al*. 2002) in Anatolia. Fairbairn *et al*. (2002) also report small frequencies of *Juniperus* sp. at Çatalhöyük in association with higher frequencies of *Celtis* sp., the latter of which they report was "used as wine in later time periods" (Fairbairn *et al*. 2002, p. 42). *Celtis* seeds were recovered from the wine fermentation tank of the producing installation at Areni-1, so it is possible that in addition to grapes, *Celtis* was also used to produce wine.

Remains of *Elaeagnus* L. (oleaster) were also recovered from Medieval strata at Areni-1. Sturtevant (Hedrick 1919) reports the consumption of *Elaeagnus angusifolia* fruit, which is dry and mealy, yet sweet, across Europe and northern Asia. Within Armenia, both *E. angustifolia* L. and *E. orientalis* L. occur within the Arpa River valley today (Gabrielian and Zohary 2004, Fig. 88). Gabrielian and Zohary (2004) note that in addition to being cultivated for its fruit, roughly 50 distinct cultivars are currently valued for their ornamental qualities and their attractiveness to honey bees. Archaeologically, *Elaeagnus* sp. has been reported at Neolithic Aknashen in the Ararat valley in Armenia (Hovsepyan and Willcox 2008) and Early Bronze Age Sarazm located in northwestern Tajikistan where Spengler and Willcox (2013) suggest that it was intentionally gathered for consumption.

Together, these remains document gathering of wild fruits and hint strongly towards the intentional cultivation of other fruits. Much of the existing research regarding the nature and timing of tree fruit domestication points towards the southern Caucasus as a likely origin (Zohary *et al*. 2012). The ongoing study of plant remains from Areni-1 will undoubtedly provide a wealth of information relevant to discussions of domestication of several fruits. Detailed morphometric studies of the following fruits: apricot (*Armeniaca vulgaris* Lam.), plum (*Prunus* L.), grape (*Vitis* L.), are ongoing.

A large number of apricot (*Armeniaca vulgaris* Lam., synonymous with *Prunus armeniaca* L.) endocarps have been recovered from Medieval levels at Areni-1 (Figure 8: 4). Owing to the excellent preservation conditions, mesocarp (pulp) has also preserved in some instances. Today, Armenia is famed for cultivating apricots, but the origin of domesticated apricot is still poorly understood. While some believe that apricot originated in China, others argue that evidence for this is scanty and that domestication may have taken place in Armenia (Agulyan and Asatryan 1981, p. 13; Gladkova 1981, p. 186; Stepanyan and Stepanyan 2011, p. 190). Wild forms of apricot are well documented from the Tien Shan Range of Central Asia, Northeastern China, Korea, and eastern Siberia, but smaller stands also exist within Dagestan and Armenia (Gabrielian and Zohary 2004,

p. 62; Zohary *et al*. 2012, p. 144). The *Flora of Armenia* (Takhtajan 1958, p. 308) notes that many forms of apricot exist within Armenia, but only cultivated species are listed. Since the publication of the third volume of the *Flora of Armenia* in 1958, isolated stands of wild apricot have been reported within the Aragats, Zangezur, and Daralagyaz floristic regions, the latter of which spans the Arpa River valley where Areni-1 lies (Gabrielian and Zohary 2004, Fig. 84). Consequently, wild stands of apricot would most likely have been available to occupants of the cave in antiquity.

Zohary *et al*. (2012, p. 144) report the cultivation of apricot in China around 3,000 years ago and list several early finds of apricot in Ukraine dating to ca. 6,000–4,750 Cal BP. Within Armenia, apricot endocarps have been recovered from Early Bronze Age Garni (see Arakelyan 1951 cited in Gabrielian and Zohary 2004), further documenting an early presence in the region. The endocarp remains from Areni-1 are currently undergoing detailed morphometric analysis so it is premature to discuss their morphology in detail. It is clear, however, that variety exists within the assemblage. Given that *Armeniaca vulgaris* finds are not well reported, and that the origin of apricot domestication is uncertain, the recovery of apricot remains from Areni-1 holds great potential to enhance knowledge of the origin and spread of domesticated apricot.

A very large number of *Prunus* sp. endocarps have been recovered from both Late Chalcolithic and Medieval levels at Areni-1 (Figure 8: 5-6). Within the third volume of the *Flora of Armenia* (Takhtajan 1958, pp. 304-307), four species of *Prunus* (plum) are reported: *P. spinosa* L. and *P. divaricata* L. db., both of which are wild forms; *P. domestica* L., which is a cultivated form; and *P. insititia* Julsen, which may be considered a wild form or a semi-domesticated form when referred to as *P. domestica* subsp. *insititia* (L.) C.K. Schneid. According to Gladkova (1981, p. 186) *P. domestica* subsp. *insititia* represents a very large group that contains an enormously diverse range of varieties. She notes that *Prunus domestica* resulted from the hybridization of black thorny (*P. spinosa*) and cherry-plum (*P. divaricata*). The morphological diversity of *Prunus* endocarps from Areni-1 strongly suggests that a number of species are present at the site. Consequently, it may be possible to document *Prunus* domestication at Areni-1. Assigning species to the archaeological remains and confirming this, however, is currently constrained by a lack of reliable criteria to morphologically distinguish between the endocarps. A detailed morphometric study of modern endocarps collected in Armenia from each of the four *Prunus* species is currently underway in order to develop the criteria needed to reliably distinguish between the archaeological remains.

Very early finds of *Prunus* exist within the archaeobotanical literature. Martinoli and Jacoment (2004), for example, identified *Prunus* endocarp fragments from Epipalaeolithic levels at Özükini in southwestern Anatolia. *Prunus* endocarps have also been recovered from Neolithic

and Bronze Age sites across Europe (Zohary *et al*. 2012 provide a useful synthesis of finds). It is not until Roman times, however, that undisputed evidence for the domesticated form, *Prunus domestica*, is found across Europe with repeated finds of *domestica*-type endocarps across Germany and well-preserved wall paintings of the tree at Pompeii in Italy (Zohary *et al*. 2012). Given the abundance of wild *Prunus* types in Armenia, the likelihood of domestication taking place in the Caucasus is high. The ongoing study of *Prunus* remains from Areni-1 will undoubtedly contribute greatly to ongoing considerations of *Prunus* domestication.

A diverse range of *Vitis* sp. remains have been recovered from Areni-1 (Figures 9 and 10). Remains dating to the Late Chalcolithic, Middle Bronze Age and Medieval occupations include grape pips, intact desiccated berries with skin preserved, rachises and pedicels, as well as cut segments of vine wood (Table 2). Strong evidence exists for wine production during the Late Chalcolithic at Areni-1. Within the central gallery of the cave, numerous storage jars associated with a packed clay platform that slopes towards a large ceramic jar were exposed in Trench 1. These remains date to 4,230–3,790 Cal BC (OxA-18197, UCIAMS-40184) and have collectively been interpreted as a grape pressing installation used for wine production. Barnard *et al*. (2011) detected the presence of anthocyanin malvidin, a pigment that gives red wine its color, on ceramic sherds from the installation, providing additional support for wine production at Areni-1 around 4000 BC. While wine is known to have been produced much earlier, around the mid-sixth millennium BC (Miller 2008), Areni-1 is believed to be the oldest wine-making centre in the world. The area surrounding the site continues to be known for wine production today.

Breath (B) and length (L) measurements taken from 12 Late Chalcolithic grape pips from Areni-1 were used to calculate the Stummer's Index (B/L × 100) (Stummer 1911 cited in Jacquat and Martinoli 1999). The Stummer's Index for 12 pips vary between 54.4 and 71.7, placing the remains firmly within the intermediary category (according to the Stummer's Index, wild specimens = 76–83 and domesticated species = 44–53). A more detailed study is underway using a larger sample size to compare the Areni-1 grape pips to modern comparative material from wild and domesticated grape varieties from Armenia.

4.2. Cereals

In addition to a wide variety of fruit, cereals were also recovered from both Late Chalcolithic and Medieval occupations (Figure 11). Cereals would have served as important staple crops during both of these periods and, indeed, have a long history of use within Armenia. Hovsepyan and

Willcox (2008), for example, report Neolithic finds of *Triticum monococcum* (einkorn), *T. dicoccum* (emmer), free-threshing forms of wheat, and *Hordeum vulgare* (barley) and *H. vulgare* var. *coeleste* dating to the 6th millennium Cal BC at Aratashen and Aknashen in the Ararat Valley of Armenia. At Areni-1, both wheat and barley have been recovered (Figure 11: 5-6). Free-threshing wheat has been recovered from Chalcolithic and Medieval levels along with grains that strongly resemble *T. dicoccum* (emmer). While cereals would have been widely consumed at Areni-1, their use was not restricted to subsistence. Intact cereal spikes were used to impress and decorate ceramic vessels. Examination of a number of pottery vessels from Areni-1 has also demonstrated that straw was used to temper clay.

By the Medieval period, millet (*Panicum* sp.) and sorghum (*Sorghum* sp.) are also present at Areni-1 documenting their introduction into the area (Figure 11: 2, 7-8). The location and timing of *Panicum miliaceum* L. (broomcorn millet) domestication is currently poorly understood and investigations are complicated by the morphological similarity between *P. miliaceum* and *Setaria italica* (L.) P. Beauv. (foxtail millet) grain. In an archaeobotanical study of early *P. miliaceum* and *S. italica* finds in the Old World, Hunt *et al*. (2008) note the presence of both species in northern China prior to 5,000 Cal BC along with contemporary finds across Eurasia. The remains from Areni-1 certainly provide support for intensive cultivation of *Panicum* sp. in the Caucasus by the Medieval period.

Our understanding of sorghum domestication suffers from lack of clarity, but is marginally better understood than millet. Today sorghum is grown extensively in Africa, Southwest Asia, and the Indian subcontinent (Zohary *et al*. 2012). Given that the wild progenitors of *Sorghum bicolor* (L.) Moench are restricted to sub-Saharan Africa and Yemen, domestication is thought to have occurred in Africa rather than in Asia, although much more work needs to be done in sub-Saharan Africa to confirm this. If domesticated sorghum did migrate out of Africa northwards, its presence at Areni-1 during Medieval times is very interesting, since sorghum has not yet been recovered from Medieval sites in Syria and is rarely encountered in the Mediterranean during Roman times (Zohary *et al*. 2012, p. 73), suggesting that the crop would have somehow bypassed these regions. Research in India indicates that sorghum was present in South Asia by 2,000 BC (Nesbitt 2005, p. 57). The forms of sorghum grown in Southwest Asia, India and Pakistan today are dominated by the free-threshing *durra* type. Since the *durra* form is not prevalent in Africa, and is restricted largely to Ethiopia, Harlan and Stemler (1976, p. 474) speculated some time ago that primitive *bicolor* plants were introduced to India where they evolved into the *durra* form. They further speculate that the *durra* form was then introduced to areas to the west of India. The presence of *Sorghum* during

Medieval times at Areni-1 along with other crops that were introduced from the east would lend support to this assertion.

4.3. Other food crops

Other food crops recovered from Areni-1 include *Lens* sp. (lentil), *Rubus* sp. (blackberry/raspberry), *Citrullus* sp. (water melon), *Melo* sp. (melon), *Cucurbit* sp. (cucurbit), *Capparis* sp. (caper), *Coriandrum* sp. (coriander) and large amounts of *Beta* sp. (beet) seeds. A remarkable, well-preserved Medieval fabric bundle was recovered from Areni-1 containing large numbers of *Beta* sp. seeds together with smaller amounts of *Coriandrum* sp., *Linum* sp., *Gossypium* sp., *Medicago* sp. (medick), *Triticum* sp. (wheat), *Hordeum* sp. (barley), *Panicum* sp. (millet), *Thlaspi* sp. (pennycress), *Alyssum* sp. (alyssum) seeds, and a diverse range of weeds seeds. Many of the species within the bundle were important field crops during the Medieval period and would have served as staple foods for the local population. It is possible that the contents of the bundle were kept as seed stock for future plantings.

4.4. Fiber plants

Fiber crops recovered from Areni-1 include *Gossypium* sp. (cotton) and *Linum* sp. (flax), both of which occur in Medieval layers (Figures 5: 2 and 12). The preservation of cotton is exceptional and includes seeds, opened bolls, cotton fibers, as well as woven textiles (Figure 12: 3-4). It is not known precisely when cotton was introduced to the Caucasus from the Indian subcontinent, but excavations at Kara-tepe in northwestern Uzbekistan have yielded evidence for cotton dating to ca. 300–500 AD (Brite and Marston 2013). Further analysis and dating of the cotton remains from Areni-1 will undoubtedly contribute much to the discussion of the diffusion of cotton cultivation across Asia.

Late Chalcolithic textiles and basketry have also been recovered from Areni-1. A textile fragment excavated from Chalcolithic Horizon II in Trench 1 was woven from spun linen (*Linum usitatissimum* L.). Intact basket fragments have been recovered from both Late Chalcolithic and Medieval levels at Areni-1 (Stapleton *et al*. this volume, Figure 12: 2). The baskets tend to be created from plant fibers that are thicker and more resilient than textile fibers. Poaceae plant stems were widely exploited across the site. Large quantities of *Phragmites* sp. (reed) stems have been recovered from various parts of the excavations and it would appear that the fibers were being processed on site. Creative use was made of the stems and the bright inner and darker outer portions of the stems were differentially woven to create patterns. Interestingly, reed stems were

also recovered from inside one of the earthenware wine pots or kareses near the wine pressing installation together with grape trunks (Figure 3: 2). While describing stores in an Armenian village dwelling, the 5th century BC Greek historian Xenophon wrote in his "Anabasis" the following:

> There was also wheat, barley, beans, and barley wine in big bowls. The very grains of the barley were in it, floating level with the brim, and there were reeds lying in it, some of which were longer, others shorter, but without joints. When one was thirsty, he had to take one of these to his mouth and suck. It was quite unmixed (and strong), unless one poured in a bit of water, and the drink was quite pleasant for one who had learned to be familiar with it. (Xenophon 2008, p. 138, Book IV, Chapter V).

It is highly likely that reed stems were used as straws for drinking wine at Areni-1. A similar use of reeds is depicted on several Early Dynastic Mesopotamian seals illustrating communal drinking and feasting and straws have also been recovered from elite burials at Ur (Joffe 1998 provides a brief review). These finds further document the ritual use of the inner part of the cave during the Late Chalcolithic.

Additionally, a leather shoe packed with wild grasses was recovered from the base of a Late Chalcolithic pit within Trench 3. The grasses helped retain the form of the shoe and keep it dry. Leather from the shoe has been radiocarbon dated to 3,627–3,377 Cal BC (OxA-20581, OxA-20582, UCIAMS-65186), and dates for the associated grasses are contemporary (OxA-20583), making this find the world's oldest leather shoe (Pinhasi *et al*. 2010).

5. Conclusions

The archaeobotanical remains from Areni-1 provide a rich record of plant use during the Late Chalcolithic and Medieval periods. The extraordinary preservation of plant remains allows us to consider various uses of plants that extend beyond traditional studies of subsistence. Well preserved textiles, basketry, and even reed drinking straws used to consume wine attest to the richness of plant use at the site.

While some plants were used during both periods, suggesting continuity of resource exploitation in the area, the archaeobotanical record also documents the introduction of new species from other regions. Free-threshing wheats and barley were cultivated and *Celtis* fruits were gathered in both Late Chalcolithic and Medieval periods. Likewise, *Vitis* and *Prunus* remains are evident in both time periods. It is unclear at present whether grapes and plum were being

intentionally cultivated during the Late Chalcolithic and had reached the point of domestication, but both plants were heavily exploited. By the Medieval period, cotton, sorghum, and millet had been introduced to the region and are evident at the site in significant numbers. A much wider range of fruits remains are also present during the Medieval occupation, documenting the intense use of fruit crops in the region. This phenomenon continues today. The archaeobotanical remains from Areni-1 have enormous potential to provide information on the domestication of a variety of fruits. Detailed morphometric studies of *Prunus*, *Armeniaca*, *Cerasus*, *Persica*, *Amygdalus*, *Juglans*, and *Vitis* are currently ongoing and will contribute much needed information on the role that the southern Caucasus played in this process.

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Table 1

Plant remains recovered from Chalcolithic and Medieval levels at Areni-1. Nomenclature follows Takhtajan 1954–1987; 1995; 2001–2010 and Cherepanov 1995.

Family	Genus	English common name	Armenian common name	Chalcolithic	Medieval	Mixed
Aceraceae	*Acer* L.	Maple	Tkhki	+	+	
Alliaceae	*Allium* L.	Onion	Sokh			+
Apiaceae	*Coriandrum* L.	Coriander	Hamem		+	
	Heracleum L.	Cow-parsnip	Baldrghan			+
Asteraceae	*Achillea* L.	Yarrow	Hazaraterevuk		+	
Boraginaceae	*Lithospermum* L.	Gromwell/Stoneseed	Kakavkrkut			+
Brassicaceae	*Alyssum* L.	Alyssum	Varvruk			+
	Brassica L./*Sinapis* L.	Brassica/Mustard	Kaghamb/Mananekh			+
	Camelina Crantz.	False flax	Soruk			+
	Thlaspi L.	Pennycress	Shnkotem			+
Capparaceae	*Capparis* L.	Caperbush	Kapar		+	
Chenopodiaceae	*Beta* L.	Beetroot	Bazuk		+	
Cornaceae	*Cornus* L	Cornelian cherry/ Dogwood	Hon			+
Cucurbitaceae	*Citrullus* Forsk.	Water melon	Dzmeruk		+	
	Cucurbita L.	Cucurbit	Ddum		+	
	Melo Adans.	Melon	Sekh		+	
Cupressaceae	*Juniperus* L.	Juniper	Gihi		+	
Elaeagnaceae	*Elaeagnus* L.	Oleaster	Pshateni		+	
Fabaceae	*Lathyrus* L.	Vetchling	Tapvolor			+
	Lens Adans.	Lentil	Vosp			+
	Medicago L.	Medick	Arvuyt			+
Juglandaceae	*Juglans* L.	Walnut	Ynkuzeni		+	
Lamiaceae	*Leonurus* L.	Motherwort	Aryutsagi			+
Linaceae	*Linum* L.	Flax	Ktavat		+	
Malvaceae	*Gossypium* L.	Cotton	Bambak		+	
Oleaceae	*Fraxinus* L.	Ash tree	Hatseni		+	
Papaveraceae	*Glaucium* Adans.	Horned poppy	Tsaghkakakach			+
	Papaver L.	Poppy	Kakach		+	
Poaceae	*Agropyron* Gaertn.	Crested-wheat grass	Sez		+	
	Hordeum L.	Barley	Gari	+	+	
	Oryza L.	Rice	Brindz			+
	Panicum L.	Millet	Korek			+
	Phragmites Adans.	Reed	Yegheg	+	+	
	Sorghum Moench	Sorghum	Sorgo		+	
	Triticum L.	Wheat	Tsoren	+	+	
Polygonaceae	*Polygonum* L.	Knotweed	Matitegh			+
Ranunculaceae	*Delphinium* L.	Larkspur	Vojlakhot			+
	Ranunculus L.	Buttercup	Gortnuk			+
Rosaceae	*Amygdalus* L.	Almond	Nsheni		+	
	Armeniaca Mill.	Apricot	Tsiraneni		+	
	Cerasus Juss.	Cherry	Baleni		+	
	Crataegus L.	Hawthorn	Szni, Alotch			+
	Persica Mill.	Peach	Deghdzeni		+	
	Prunus Mill.	Plum	Saloreni, Dambul	+	+	
	Pyrus L.	Pear	Tandzeni		+	
	Rosa L.	Rose	Masreni		+	
	Rubus L.	Raspberry/Blackberry	Aznvamori/Mosheni			+
Rubiaceae	*Galium* L.	Bedstraw	Makardakhot			+
	Rubia L.	Madder	Toron			+
Solanaceae	*Hyoscyamus* L.	Henbane	Bangi		+	
Tamaricaceae	*Tamarix* L.	Tamarisk	Karmran	+		
Ulmaceae	*Celtis* L.	Hackberry	Prshni	+	+	
Valerianaceae	*Valeriana* L.	Valerian	Katvakhot			+
Vitaceae	*Vitis* L.	Grape	Khaghogh	+	+	

Table 2

AMS 14C determinations for the grapes from Areni-1 (calibrated using OxCal Ver. 3.5 based on the last atmospheric dataset OxCal v.3.10 (Bronk Ramsey and Lee 2013) and IntCal13 (Reimer *et al*. 2013).

N	Lab number	Context	Dated object	Date	Calibrated age range (68.2% probability)	Calibrated age range (95.4% probability)
1	UCIAMS-40184	Trench 1, Unit 1002, Locus 11	*Vitis* sp., trunk	5240±20 BP	4050–3990 BC	4230–3970 BC
2	AA-95788	Trench 1, Unit 3, Sq.R19/20, Locus 2, Spits 6–7	*Vitis* sp., trunk	5096±41 BP	3960–3800 BC	3980–3790 BC
3	AA-95789	Trench 3, Sq.J26, Spit 11	*Vitis* sp., trunk	5055±47 BP	3950–3790 BC	3970–3710 BC
4	AA-95788	Trench 1, Unit 3, Square R18, Locus 19, Spit 3	*Vitis* sp., trunk	3694±41 BP	2140–1980 BC	2200–1950 BC
5	AA-103199	Trench 1, Unit 3, Sq.N17, Locus 27	*Vitis* sp., trunk	1567±32 BP	435–535 AD	410–600 AD
6	AA-103198	Trench 3, Sq.I23/J24, Sp.6	*Vitis* sp., trunk	1132±40 BP	885–985 AD	780–1000 AD
7	OxA-24177	Trench 1, Unit 3, Sq.L18, Pit 1, Spits 8–25	*Vitis* sp., trunk	841±24 BP	1160–1245 AD	1150–1270 AD
8	AA-103200	Trench 1, Unit 3, Sq.N16, Locus 76a	*Vitis* sp., trunk	840±32 BP	1160–1255 AD	1060–1280 AD
9	OxA-24048	Trench 1, Unit 3, Sq.N16, Locus 29	*Vitis* sp., trunk	831±24 BP	1190–1260 AD	1160–1270 AD
10	OxA-24178	Trench 1, Unit 3, Sq.L18, Pit 1, Spits 8–25	*Vitis* sp., trunk	817±24 BP	1215–1259 AD	1185–1280 AD

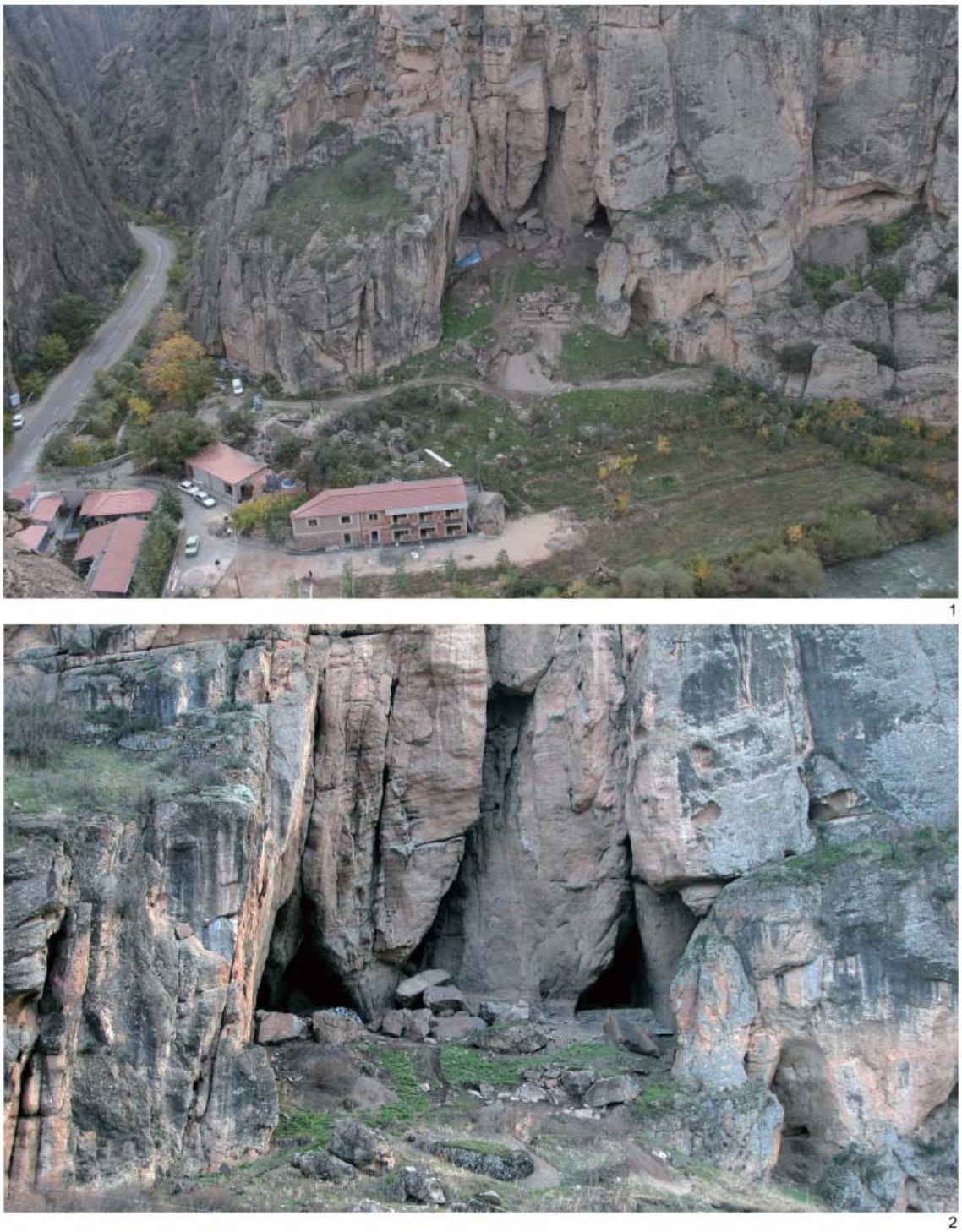

Figure 1

1. Photograph showing the Arpa River canyon and the junction with the Gnishik tributary in the foreground and Areni-1 cave in the background; 2. Photograph showing the main view of the entrance of the cave.

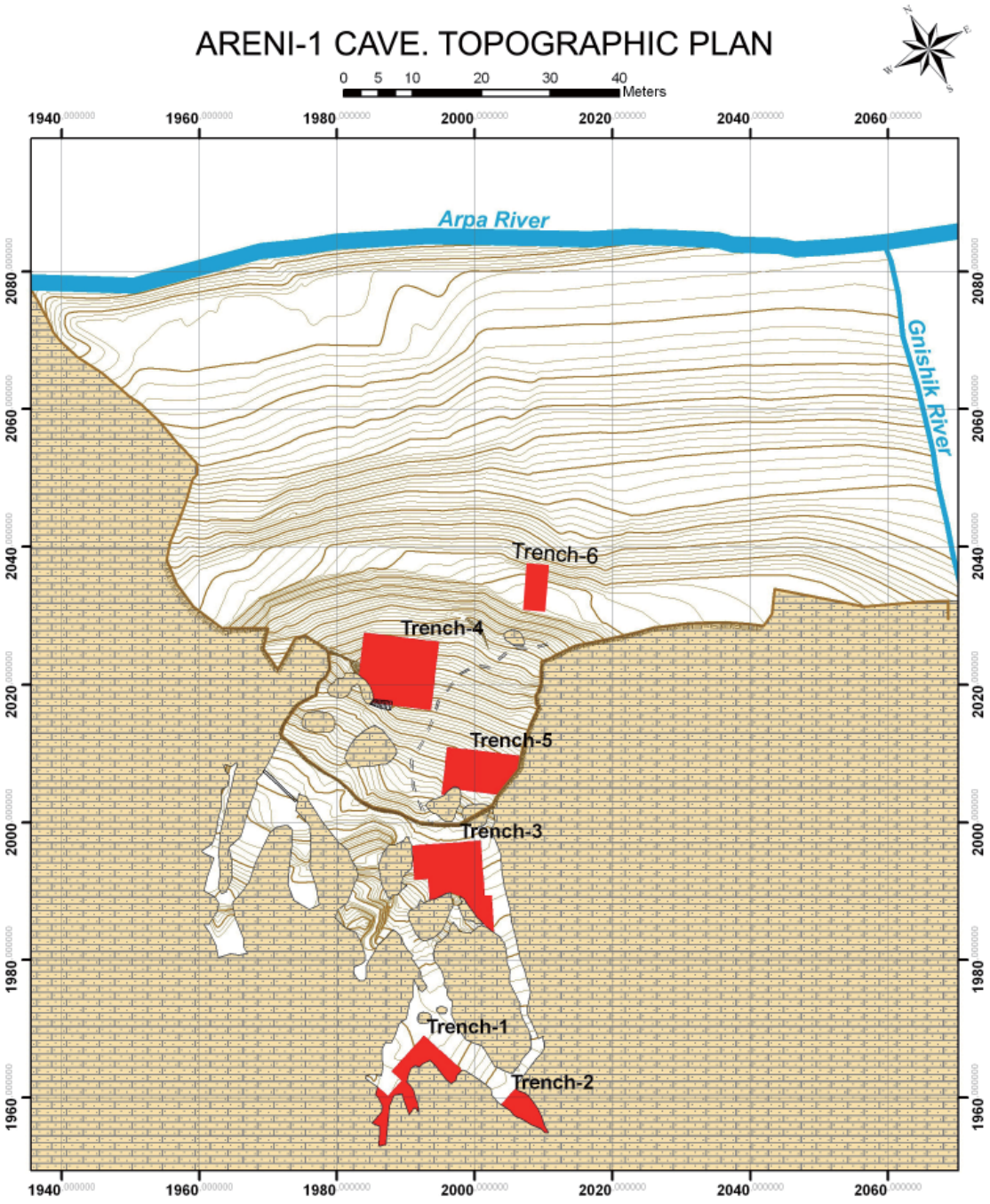

Figure 2

Topographic plan of the cave highlighting the location of Trenches 1–6.

1

2

Figure 3

1. Photograph of the grape pressing installation used for wine production in Trench 1; 2. Photograph showing earthenware pots (karases) used for storing wine near the pressing installation. Grape wood and reed stems are preserved in one of them (Locus 11).

1

2

Figure 4

1. Photograph showing the main view of Trench 2; 2. Two-handled vessel discovered within Trench 2 filled with desiccated plant remains.

Figure 5
1. Photograph showing the main view of Trench 3; 2. Photograph showing a concentration of cotton seeds in Trench 3 (Square L35).

Figure 6
1. Photograph showing main view of Trench 4; 2. Photograph showing transverse section in Trench 4.

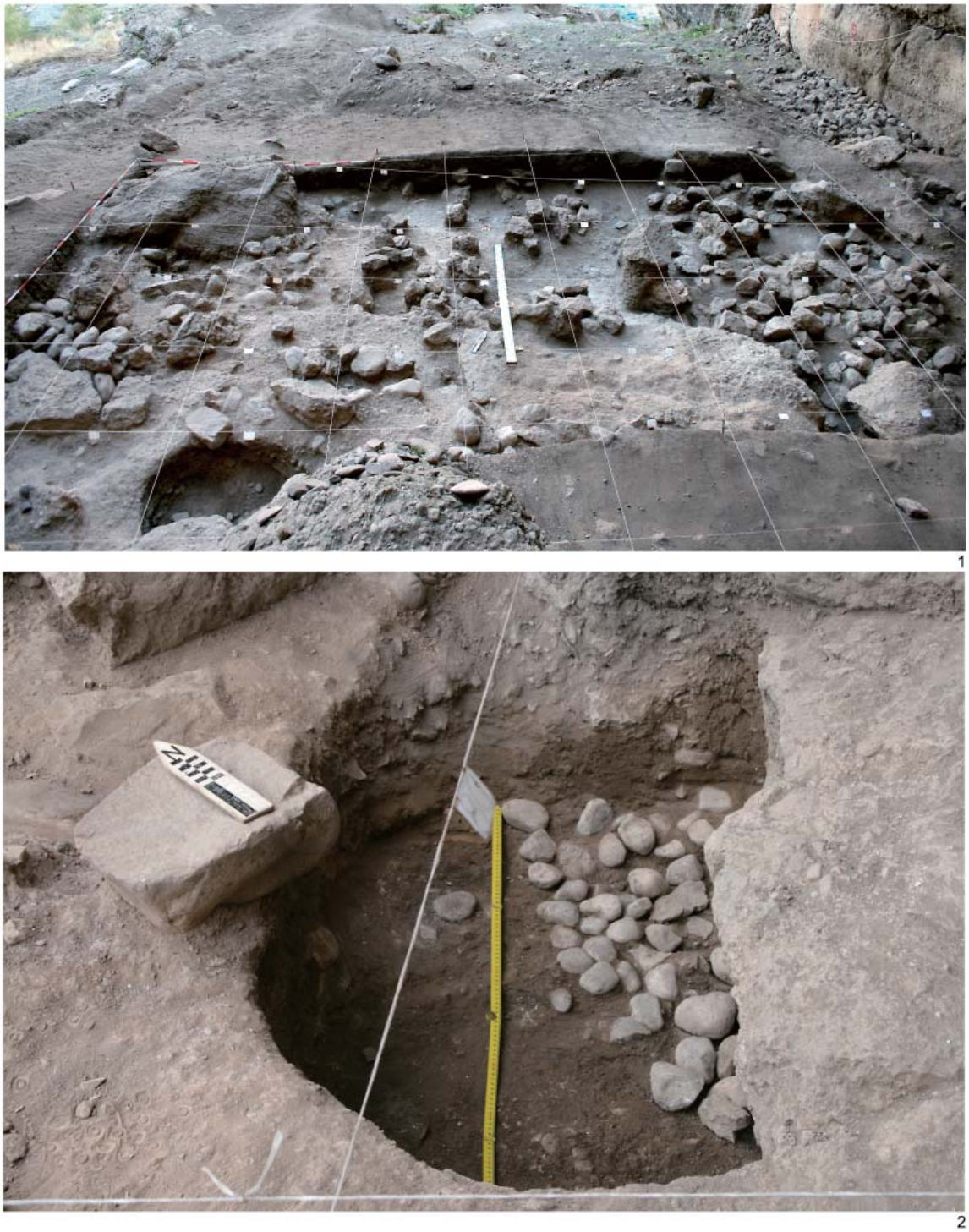

Figure 7
1. Photograph showing main view of Trench 5; 2. Photograph showing the Chalcolithic household pit excavated in Trench 5.

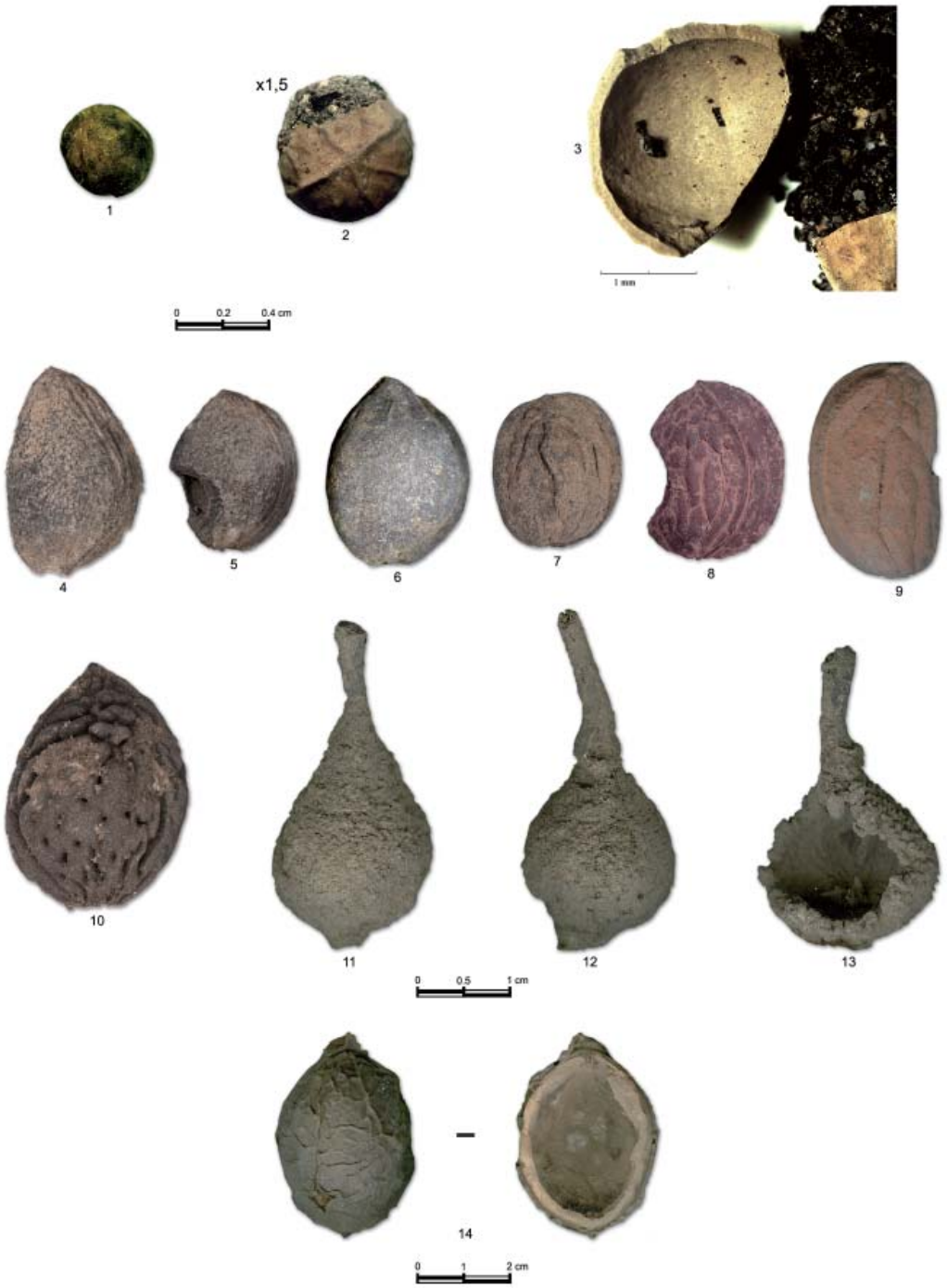

Figure 8

Photographs of plant remains. 1. *Celtis* sp. stone; 2. *Celtis* sp. stone; 3. Broken *Celtis* sp. stone and contents; 4. *Armeniaca* sp. endocarp; 5. *Prunus* sp. endocarp; 6. *Prunus* sp. endocarp; 7. *Amygdalus* sp. endocarp; 8. *Amygdalus* sp. endocarp; 9. *Amygdalus* sp. endocarp; 10. *Persica* sp. endocarp; 11. Desiccated *Pyrus* sp. fruit; 12. Desiccated *Pyrus* sp. fruit; 13. Desiccated *Pyrus* sp. fruit; 14. *Juglans* sp. endocarp.

Figure 9
Photographs of plant remains. *Vitis* sp. 1–4. Stems; 5. Bark; 6. Pedicels.

Figure 10
Photographs of plant remains. *Vitis* sp. 1–13. Pips.

Figure 11

Photographs of grass (Poaceae) remains. 1. *Panicum* sp. panicle; 2. *Sorghum* sp. panicle; 3. Free-threshing *Triticum* sp. culm and rachis segments; 4. *Triticum* sp. ear; 5. *Triticum* sp. caryopsis; 6. *Hordeum vulgare* L. caryopsis; 7. *Panicum* sp. caryposis; 8. *Panicum* sp. spikelet; 9. *Oryza* L. spikelet.

Figure 12

Photographs of fiber-related remains. 1. *Phragmites* sp.; 2. Chalcolithic period basketry fragment; 3. *Gossypium* sp. boll; 4. Medieval cotton textile fragment; 5. Fragment of a Chalcolithic linen fishing net.

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